

## New Parasitoid Species of *Cinara*- aphids on Conifers from Korea (Hymenoptera, Braconidae, Aphidiinae)

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**Abstract** Three new species of aphid parasitoids and their host-plant associations are described: *Pauesia koraiensis* Starý (*Cinara cembrae* Inouye and *C. sp.* on *Pinus koraiensis*), *Pauesia holmani* Starý (*Cinara sp.* and *C. watanabei* Inouye on *Pinus koraiensis*, and *C. laricis* Hartig on *Larix olgensis*) and *Pauesia gwangleungensis* Starý (*Cinara shinjii* Inouye on *Pinus parviflora*).

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**Key words** Aphidiinae, Braconidae, *Pauesia*, new species, host-parasitoid, Korea

### INTRODUCTION

The knowledge of aphid parasitoids of the Korean peninsula represents an important supplement to the research on the Far East Asian fauna, due to several reasons such as species richness, parasitoid-aphid-plant associations, biodiversity studies and, last but not least, search for some species as potential biocontrol candidates in the world. The present study is the result of a collaboration between NIAST and the Academy of Sciences of the Czech republic (ASCR).

In Korea, Starý and Choi (2000) presented the list of aphidiine species based on the former taxonomic works. According to it, 62 species were recognized in Korea.

### MATERIALS AND METHODS

The parasitoids were obtained by rearing of field-collected aphid colonies in the laboratory. The sample data followed the requirements for the on-going elaboration of the database, i.e., parasitoid species, aphid species, host plant (habitat), date and collector or sample code. The sample code is mentioned in brackets at the end of each sample reference.

The material of the individual samples is deposited in both the collaborative institutions. Holotypes are

deposited in collection of P. Starý (c/o Institute of Entomology, ASCR), paratypes in both the institutions.

The nomenclature of body structure followed Huber and Sharkey (1993) and Smith (1944), except for wing-venation (cf. Starý 1970), which is explained in the figures.

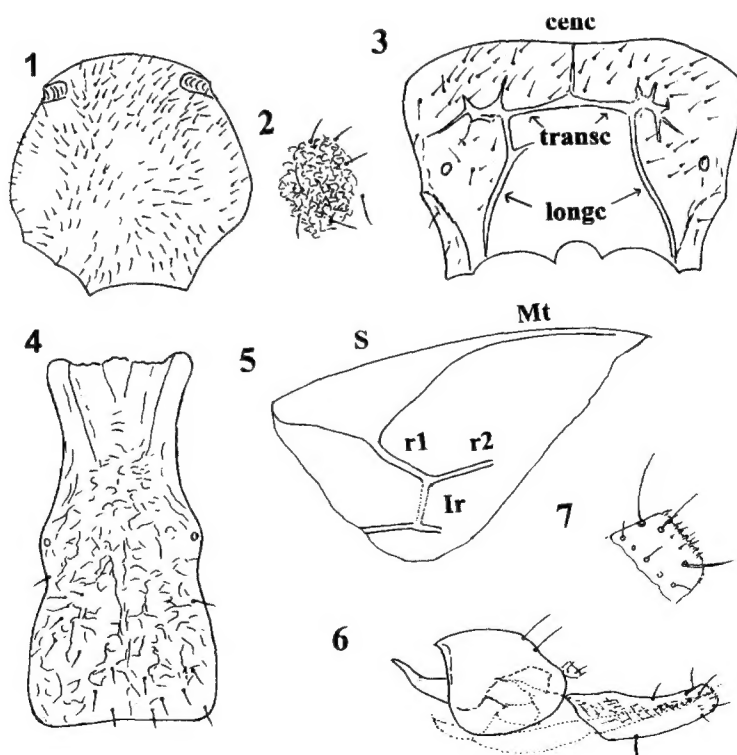
## DESCRIPTIONS

The Korean species of *Pauesia* were reviewed by Starý and Choi (2000), with seven species in the list. The new species described below can be partially keyed out using the keys by Takada (1968) and Watanabe and Takada (1965). All the diagnoses and key-characters were drawn, based on females.

### *Pauesia koraiensis* Starý, n. sp.

(Figs 1–7)

*Diagnosis.* The new species can be easily distinguished from its Korean congeners by the shape of



**Figs 1-7.** *Pauesia koraiensis*, female paratype (illustrations not drawn to equal scale): 1, mesonotum; 2, surface of mesonotum, detail; 3, propodeum; 4, 1st metasomal tergum; 5, forewing; 6, genitalia; 7, a part of the apex of ovipositor sheath, detail. Abbreviations: Forewing : S–stigma. Mt–metacarp. r1–radial abscissa 1. r2–radial abscissa 2. Ir–inter-radial vein. Propodeum : cenc–central carina. transc–transverse carinae, longc–longitudinal carinae.

ovipositor sheaths (narrow, arcuate, apical setae with tubeworm base), by areolation of propodeum (central areola very large and broadening in the distal portion), by conspicuously gibbous metasomal tergum 1 (when viewed from side), and by 20–21 segmented antenna.

Female. Length of body: 3.0–4.0 mm. Eyes large, sparsely setose. Transfacial line  $1/2$  head width. Malar space a little longer than tentorio–ocular line, or as 0.4 eye length. Tentorio–ocular line subequal to intertentorial line. Antenna 20–21 segmented, reaching to mid metasoma, not thickened to the apex. Flagellomeres not gradually longer from the middle to the apex of flagellum. Flagellomere 1 (= F1) twice as long as broad, the setae subequal to half of its width, with 5 longitudinal placodes. F2 subequal to F1, with 5 placodes. Mesonotum (Figs 1, 2): Projecting over prothorax when viewed from side, relatively densely setose, with small glabrous areas on the lobes, feebly superficially rugose. Notauli distinct anteriorly. Propodeum (Fig. 3) distinctly areolated. Longitudinal carinae divergent distally so that central areola broadening in its distal portion. Forewing (Fig. 5): Stigma broadly triangular, length about 2.5–3 width. Metacarpus about  $1/4$ – $1/6$  shorter than stigma. Radial abscissa 1 (= r1) equal to stigma width. Interradial vein (= Ir)  $1/3$  shorter than r1. Legs normal. Metasomal tergum 1 (Fig. 4): 2.5 times as long as width across spiracles, coarsely rugose, with central longitudinal rugose carina in the second third, only slightly wider at apex than at spiracles, conspicuously gibbous when viewed from side. Genitalia (Figs 6, 7): Ovipositor sheaths narrow and arcuate, apical setae with tubiform base. Coloration: Head bicolorous, brown, face and lower part of head yellow brown, and mouthparts light yellow. Antenna brown, scape and pedicel yellow, sometimes with brownish markings. Mesosoma bicolorous, prevalently dark brown, propleuron yellow brown, prosternum yellow, and mesopleuron with yellow brown patterns in the upper third. Tegulae brown. Wing venation brown, stigma unicolorous brown. Legs yellow, apex of tarsi slightly infuscated. Metasoma bicolorous, tergum 1, 2 and 3 yellowish, tergum 1 sometimes infuscated, central part of metasoma brown, apex yellow, and sometimes infuscated. Ovipositor sheaths dark brown.

Male. Antenna 23-segmented. Head dark brown, lower part of clypeus and mouthparts yellowish. Antenna dark brown, scape and pedicel with yellow brown patterns. Mesosoma completely dark brown. A part of metasomal tergum 2–3 yellow brown. Otherwise like the female. Mummified aphids are black.

*Materials examined.* *Cinara* sp.: female, Wonju, 22 V 1999, on *Pinus koraiensis*, holotype; 1 male, 5 females, same data as holotype, paratypes (99HA446). *Cinara cembrae* Inouye: 1 female, Suwon-si, 9 V 1999, on *Pinus koraiensis*, paratype (99HA23).

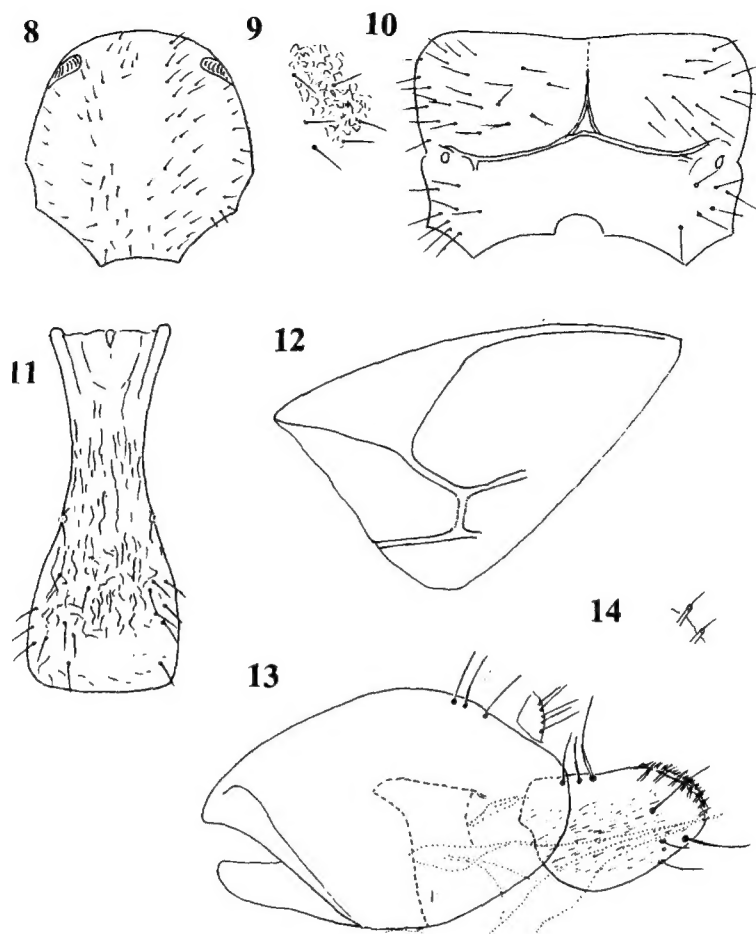
*Etymology.* The name of the species is derived from the respective host aphid–plant association (*Pinus koraiensis*).

### ***Pauesia holmani* Starý, n. sp.**

(Figs 8–14)

*Diagnosis.* It is characterized by the incomplete areolation of the propodeum (merely the central carina bifurcating distinctly into complete transverse carinae), 21–24 segmented antenna and broad ovipositor sheaths.

Female. Length of body: 3.8–4.0 mm. Eyes large, sparsely setose. Transfacial line  $1/2$  head width. Malar space  $1/3$  eye-length, or about equal to tentorio–ocular line, the latter subequal to intertentorial



**Figs 8-14.** *Pauesia holmani*, female paratype (illustrations not drawn to equal scale): 8, mesonotum; 9, surface of mesonotum, detail; 10, propodeum; 11, 1st metasomal tergum; 12, forewing; 13, genitalia; 14, a part of the apex of ovipositor sheath, detail.

line. Antenna 21-24 segmented, reaching to mid metasoma, not thickened to the apex, flagellomeres gradually shorter from middle to apex of flagellum. Flagellomere 1 twice as long as wide, setae equal to half of their width, with 2-4 longitudinal placodes. F2 equal to F1, with 5-6 placodes. Mesonotum (Figs 8, 9): Projecting over pronotum when viewed from side, sparsely setose, with large glabrous areas on the lobes, feebly superficially rugose. Notauli distinct anteriorly. Propodeum (Fig. 10) incompletely areolated, the central carina bifurcating into complete and distinct transverse carinae, rarely with short incomplete indications of longitudinal carinae at their base. Forewing (Fig. 12): Stigma broadly triangular, slightly more than twice as long as wide. Metacarpus subequal to stigma length. Radial abscissa 1 (r1) about 1/5 shorter than stigma width, or twice as long as Ir 1. Metasomal tergum 1 (Fig. 11): About 4x width at spiracles, apical width twice as width across spiracles, prolongately rugose, relatively flat as seen from side. Spiracular tubercles feebly prominent, situated at half of the tergum. Genitalia (Figs 13, 14):

Ovipositor sheaths broad, apical setae with tubiform base.

Coloration: Head bicolorous, light brown, ocellar triangle dark brown, face and lower part of head yellow, mouthparts yellow. Antenna brown, scape yellow, pedicel yellow with brownish markings. Mesosoma bicolorous, prothorax and prominent base of mesonotum yellow. Wing venation brown, stigma uniformly brown. Legs yellow, apices of tarsi infuscated, hind legs infuscated. Metasoma bicolorous, tergum 1 yellow brown, tergum 2 brown, tergum 3 yellow, following tergums with brownish band in the distal third. Ovipositor sheaths dark brown.

Male. Antenna is 23–25 segmented. Coloration: Head bicolorous, prevalently brown, face and lower part yellow, palpi yellow. Antennae dark brown, scape yellow with more or less brownish markings. Mesonotum bicolorous, brown, prothorax yellow with brownish patterns on propleuron. Metasoma brown, tergum 1, 2 and 3 with lighter tinge on the sides. Mummified aphids are black.

*Materials examined.* *Cinara* sp.: holotype, female, Wonju, 22 V 1999, on *Pinus koraiensis*; paratypes, 4 female, 3 male, same data as holotype (99HA446). *Cinara laricis* (Hartig): paratypes, 3 female, 3 male, Wonju-si, 22 V 1999, on *Larix olgensis* (99HA447). *Cinara watanabei* Inouye: paratype, 1 female, Mt. Yeogi-san (Suwon-si), 12 V 1999, on *Pinus koraiensis* (99HA311).

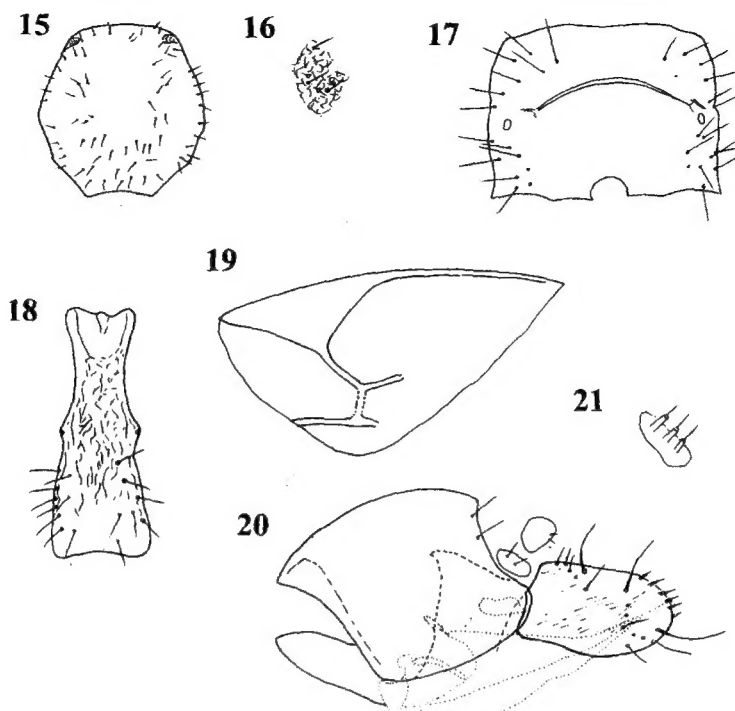
*Etymology.* The species is named in honor of J. Holman (Institute of Entomology, ASCR) for his contribution to the knowledge of aphids in Korea.

***Pauesia gwangleungensis* Starý, n. sp.**

(Figs 15–21)

*Diagnosis.* It is distinguishable from its Korean congeners by the combination of reduced areolation of propodeum (only transverse carinae developed, forming an arch), and 20–21 segmented antenna, and broad ovipositor sheaths.

Female. Length of body: about 2.6–3.5 mm. Eyes large, sparsely setose. Transfacial line 1/2 head width. Malar space 1/3 eye-length, or subequal to intertentorial line, the latter equal to intertentorial line. Antenna is 20–21 segmented, reaching to mid metasoma, not thickened to the apex. Flagellomeres gradually shorter from the middle to the apex of flagellum. Flagellomere 1 twice as long as wide, setae a little longer than half of its width, with 1 longitudinal placode. F2 is equal to F1, with 3 placodes. Mesonotum (Figs 15, 16): Projecting over pronotum when viewed from side, sparsely setose, with large glabrous areas on the lobes, surface feebly superficially rugose. Notauli distinct anteriorly. Propodeum (Fig. 17): Areolation incomplete, only the transverse carinae developed and forming an arch between the spiracles, rarely, some irregular indications of longitudinal carinae at their base. Forewing (Fig. 19): Stigma broadly triangular, length almost 3x width. Metacarp subequal to pterostigma length. Radial abscissa 1 subequal to stigma width. Interradial vein 1 is half of r1. Legs are normal. Metasomal tergum 1 (Fig. 18): 3.5 times width at spiracles, width at apex 1.5 widths across spiracles, longitudinally rugose, relatively flat when viewed from side. Spiracular tubercles are slightly prominent, situated at half of the tergum. Genitalia (Figs 20, 21): Ovipositor sheaths are broad, apical setae with tubiform base. Coloration: Head bicolorous, brown, face and lower part yellow. Mouthparts yellow. Antenna is brown, scape and a part of pedicel yellowish. Mesosoma are bicolorous, brown, prothorax and base of mesonotum yellow.



**Figs 15-21.** *Pauesia gwangleungensis*, female paratype (illustrations not drawn to equal scale): 15, mesonotum; 16, surface of mesonotum, detail; 17, propodeum; 18, 1st metasomal tergum; 19, forewing; 20, genitalia; 21, a part of the apex of ovipositor sheath, detail.

Tegulae light brown. Wing venation brown, stigma uniformly brown. Legs are yellow, hind legs and apices of all tarsi infuscated. Metasoma bicolorous, tergum 1 yellow brown, base of tergum 2 brown, remaining tergums yellowish with broad brown band in the distal half. Ovipositor sheaths dark brown.

**Male.** Antenna 23-segmented. Coloration similar but darker than in the female. Antenna completely brown. Mesosoma completely brown. Metasoma entirely light brown. Mummified aphids are dark brown.

**Materials examined.** *Cinara shinjii* Inouye: holotype, female, Gwangleung arboretum, 21 V 1999, on *Pinus parviflora*; paratypes, 4 female, 1 male, same data as holotype (99HA382).

**Etymology.** The name is derived from the type locality, Gwangleung.

## ACKNOWLEDGMENTS

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